

Abstract of Invited Talk for the Miami 2011 Conference on Particle Physics and Cosmology:

HIGH ENERGY ASTROPHYSICS TESTS OF LORENTZ INVARIANCE AND QUANTUM GRAVITY MODELS

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High energy astrophysics observations provide the best possibilities to detect a very small violation of Lorentz invariance such as may be related to the structure of space-time near the Planck scale of $\sim 10^{-35}$ m. I will discuss the possible signatures of Lorentz invariance violation (LIV) that can be manifested by observing of the spectra, polarization, and timing of γ -rays from active galactic nuclei and γ -ray bursts. Other sensitive tests are provided by observations of the spectra of ultrahigh energy cosmic rays and neutrinos. Using the latest data from the Pierre Auger Observatory one can already derive an upper limit of 4.5×10^{-23} on the fraction of LIV at a Lorentz factor of $\sim 2 \times 10^{11}$. This result has fundamental implications for quantum gravity models. I will also discuss the possibilities of using more sensitive space-based detection techniques to improve searches for LIV in the future.